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Permit No.: V-2002

## **IMPERIAL COUNTY AIR POLLUTION CONTROL DISTRICT**

150 S. Ninth Street  
El Centro, CA 92243  
(760) 339 4606

### **MAJOR FACILITY PERMIT REVIEW**

Company Name:	GEM Resources, LLC
Facility Name:	East Mesa Geothermal Projects, Plant East Mesa (PEM) Units 5 & 6.
SIC Code:	4911 (Electric Services)
Source Type:	Geothermal Power Plant
Location:	3300 E. Evan Hewes Highway, Holtville,
California.	
Mailing Address:	P.O. Box 86, Holtville, CA 92250
Responsible Official:	Jim Keener
Plant Site Contact:	Gunnar Von Kohler
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Permit Reviewer:	Reyes Romero

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## **Introduction**

Pursuant to Rule 900, of the Imperial County Air Pollution Control District Rules and Regulations, the District intends to issue a Title V Operating Permit to East Mesa Geothermal Projects, Plant East Mesa (PEM) Units 5 & 6. The East Mesa Geothermal Projects, Plant East Mesa (PEM) Units 5 & 6 is owned by GEM Resources LLC and operated by Florida Power & Light Company/Energy Operating Services, Inc. The PEM Units 5 & 6 consist of two dual-flash geothermal power plant units (PEM Units 5 & 6), a well field with wells for the production and injection of geothermal brine, and associated equipment. The facility will operate under Title V Operating Permit No. V-2002. The Operating Permit includes conditions to ensure that all Federal, State and District requirements are satisfied.

## **Project Description**

### **PEM Units 5 & 6 Electrical Generating Units**

The PEM Units 5 & 6 have been in operation since 1989. The PEM Units 5 & 6 are side-by-side dual-flash-cycle electrical generating units with a rated total capacity of 47 MW (gross), 40 MW(net). Electrical power generation is accomplished by bringing hot brines to the surface via production wells for extraction of heat and further reinjection of the residual brine.

During normal operation, the brine is flashed in high- and low-pressure flash tanks. The high- and low-pressure steam passes through the turbine and are condensed in a direct-contact condenser. Noncondensable gases are extracted from the condenser and vented to the atmosphere through the cooling tower. The condensate mixes with the circulating water and cascades through the cooling tower. A small quantity of the circulating water is discharged from the cooling tower as drift and is emitted to the atmosphere. The cooling towers at PEM Units 5 & 6 have guaranteed drift rates of 0.01% of the circulating water flow.

During unscheduled plant outages, the steam flows are temporarily directed to rock mufflers and stacks where they are released to the atmosphere. Flashed brine may temporarily be directed to the brine holding pond if the injection pumps fail.

### **Air Emissions:**

The geothermal plants have the following points of emission to the air: cooling tower

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noncondensable gases, cooling tower drift, fugitive emissions from valves and flanges, rock muffler emissions, and brine holding pond evaporative releases.

The cooling tower gases are composed mostly of the following substances: carbon dioxide, nitrogen, and methane. The cooling tower gases contain also regulated toxic substances such as: ammonia, hydrogen sulfide, benzene, mercury, radon, toluene, and xylene. The non-condensable gases are vacuumed from the condenser and routed to the cooling tower cells where the gases are dispensed to the atmosphere. Some gases dissolved in the condenser's water can be oxidized to salts or possibly air stripped by the cooling tower.

The condensate contains small amounts of brine carryover from incomplete phase separation in the flash train and  $H_2S$  and  $NH_3$  which are soluble in water. The following substances have been detected in the circulating water: ammonia, hydrogen sulfide, manganese, and zinc. Since all of these substances are solubles in water, they are emitted as drift, with exemption of  $H_2S$  and ammonia which are emitted as gases.

The geothermal plants are also a source of combustion emissions produced by internal combustion engines associated with emergency generators or equipment used for facility operation and maintenance.

#### **Current Emission Status:**

The PEM Units 5 & 6, and their wells have a potential to emit 33.0 tons per year of benzene, a hazardous air pollutant (HAP). This amount exceeds the major source threshold of 10 tons per year of an individual HAP and 25 tons per year for all HAPs in combination.

#### **Applicable Requirement**

According to the information submitted in the Title V application and the District review, the following are the Federal, State, and District requirements that apply to the facilities.

Applicable Requirement	Enforceability	Equipment Affected
Rule 111-Equipment Breakdown	Federal, District	All Equipment
Rule 117-Nuisances	Federal, District	All Equipment
Rule 201-Permits Required	Federal, District	All Equipment
Rule 202-Exemptions	Federal, District	All Equipment

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Rule 207-Standards for Permit to Construct	Federal, District	All Equipment
Permit to Operate # 2002E -Cond A. Application Compliance -Cond B. Emissions Specifications Permit does not authorize emissions in excess of Division 26, Part 4, Chapter 3, H&SC and District's Rules and Regulations. -Cond C. H <sub>2</sub> S<7.1 lbs/hr during power production -Cond D. Fugitive Dust Control. RACT shall be applied for fugitive dust (PM-10). -Cond E. Monitoring 1. Of Turbine Condenser Hot Well Condensate and Cooling Tower Blowdown 2. Of NC Gases Vented -Cond F. Reporting 1. Analysis conducted per Cond E. 2. Type and quantity of water additives 3. Net electrical MWH sold for the year 4. Standby power hours. 5. Emission inventory of toxics. 6. Total diesel 7. Production wells status -Cond F. Emergency Equipment 1. Operation 100 hr/yr for weekly maintenance 2. Operation limited to backup power 3. Hours of Operation and Routine Repairs Recording 4. Opacity 20% 5. Install operating hour-meter to the engines	Federal, District Federal, District    Federal, District  Federal, District  Federal, District  Federal, District  Federal, District	PEM Units 5 & 6 PEM Units 5 & 6    Pem Units 5 & 6  PEM Units 5 & 6  PEM Units 5 & 6  PEM Units 5 & 6  Power Gen/Fire Pump
Permit to Operate 2132C	Federal, District	Production and Injection Wells.

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Rule 401-Opacity of Emissions	Federal, District	All Equipment
Rule 403-Quantity of Emissions	Federal, District	All Equipment
Rule 405-Sulfur Compounds	Federal, District	All Equipment
40 CFR, Part 82, Stratospheric Ozone Protection	Federal, District	air-conditioning Units
Rule 900-Operating Permits	Federal, District	All Equipment
Rule 517-Emergency Variance	State and District	All Equipment
AB2588-Toxic Hot Spots Program	State and District	All Equipment

### Statement of Basis

The proposed Operating Permit includes conditions to ensure that all Federal, State and District requirements will be satisfied. Additionally, the permit has been designed to have adequate monitoring, recordkeeping and reporting requirements to demonstrate continuous compliance with the permit conditions.

The following provides additional clarification regarding certain permit changes and permit conditions.

#### 1. Permitting History for ATC #2002.

Original ATC permit # 2002 was issued to Geo Operator Corporation for a 37 MW net dual-flash geothermal power plant on November 16, 1988.

In December 1989, the project was acquired by the Geo East Mesa L.P, and the two units were later designated GEM 2 and GEM 3. The capacity of the facility was expanded to 47 MW on February 5, 1990. The numbering of the ATC permit changed to 2002A.

The Permit to Operate was amended in July 1, 1996, to include two standby power generators to the list of equipment. The Permit to Operate conditions were updated to reflect the present operation. The numbering of the Permit to Operate changed to 2002B.

In August 4, 1998, the Permit to Operate was amended to change ownership to GEM Resources, LLC. The Permit to Operate numbering changed to 2002C; however, the

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permit conditions remain exactly the same.

In July 19, 1999, the Permit to Operate was amended to change ownership to GEM Resources, LLC, Plant East Mesa (PEM) Units 5 & 6. The Permit to Operate numbering changed to 2002D; however, the permit conditions remain exactly the same.

In September 29, 1999, the Permit to Operate was amended to remove conditions D.1 and D.2 of the Authority to Construct (ATC) permit # 2002D. The Permit to Operate numbering changed to 2002E.

## 2. Permits to Operate # 2002E and 2132C Federal Enforceability

The Authority to Construct Permit 2002A was revised by the District and conditions were undated last time on August 4, 1998. The Permit to Operate 2002E superceded the Authority to Construct 2002A and it assures compliance with the SIP-Rules requirements; therefore, Permit to Operate 2002E and conditions will be incorporated into the Operating Permit as federally enforceable.

The Permit to Operate #2132C which includes the list of production and injection wells was updated on February 2, 1999. The Permit to Operate 2132C does not include conditions for the operation of the wells. The Permit to Operate 2132C superceded the preconstruction permit and it assures compliance with the SIP-Rules requirements; therefore, Permit to Operate 2132C will be incorporated into the Operating Permit as federally enforceable.

## 3. Permit to Operate # 2002D Amendment.

The Permit to Operate Conditions D.1 and D.2 were carried into the permit from the Authority to Construct # 2002A. The Permit to Operate # 2002D, conditions D.1 and D.2, required to install a continuous on-line monitor for H<sub>2</sub>S and an H<sub>2</sub>S control plan in case substantiated complains of H<sub>2</sub>S odors are received at the District's offices. The facility requested to remove these conditions from the ATC permit due to odors is not an adequate method to monitor H<sub>2</sub>S. These conditions were imposed into the permit in order to prevent complains of hydrogen sulfide smell around the facility. The plant site is located in a semi-remote area away 8 miles the nearest populated city of Holtville. The only long term exposure is the operating personnel. According to the District records, no complains of hydrogen sulfide odors have ever been received at our office. The facility was released of compliance with these requirements due to a mass flow rate limit for hydrogen sulfide is already into the permit which is considered a more reliable method to determine compliance rather than odor complains. Additionally, the facility is required to comply with

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Rule 407, Nuisance, in the event that hydrogen sulfide odors become a problem. The Permit to Operate was amended and the permit numbering changed to 2002E.

#### 4. Ammonia Emission Clarification

According to the applicant's calculations the maximum potential to emit of ammonia for the facility is 317 tons per year. Ammonia emissions were calculated based on a maximum concentration of 87.3 ppmw (0.0873%) in the high pressure steam and 63.8 ppmw (0.0683%) in the low pressure steam. Ammonia with a 20% or greater concentration is regulated under Section 112(r). Due to the concentration of ammonia in the effluent is below 20%, the ammonia emission from this facility is not considered a regulated pollutant. Ammonia is included in the list of pollutants emitted from this facility only for emission inventory purposes.

#### 5. Hydrogen Sulfide Emission Limit for PEM 5 and 6.

The Operating Permit, Condition II.4, establishes a limit of 7.1 pounds in any hour during electrical generation for total emission of hydrogen sulfide. The hydrogen sulfide is emitted to the atmosphere through the following points: cooling tower and fugitive emissions from valves and flanges. Compliance with this limit will be monitored every six months.

The exhausted steam from the turbine is transferred to the surface condenser where most of the gases will partition into the gas phase and condensate. The gases are extracted from the condenser via the noncondensable gas line to the cooling tower, where they mix with the air and water and are released to the atmosphere. The hydrogen sulfide emissions at this point are quantified by taking a sample at the noncondensable gas line and measuring the noncondensable gas flow rate.

A fraction of the hydrogen sulfide is expected to partition into the condensate. The condensate is used for the make up water to the circulating water system. The hydrogen sulfide in the condensate will be partially oxidized prior to being evolved from the circulating water. The hydrogen sulfide that partitions into the condensate is quantified by sampling the condensate line, measuring condensate flow, and using a factor to account for oxidation. A 24% oxidation rate will be assumed for oxidation of hydrogen sulfide to sulfate (Toxic Hot Spots Information and Assessment Act report, October 1, 1990) unless another oxidation rate is obtained by source testing the cooling tower exhaust.

The fugitive emissions from valves and flanges are not reported due to the difficulty to quantify this type of emission.



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The hydrogen sulfide emissions, not including fugitive, will be calculated as follows:

$$[CNG_{H_2S} \text{ (mg/Kg)} * 10^{-6} * NCGR \text{ (lb/hr)} + [CCD_{H_2S} \text{ (mg/Kg)} * 10^{-6} * CDR \text{ (lb/hr)}] * 0.76] = ER_{H_2S} \text{ (lb/hr)}$$

where,

$CNG_{H_2S}$  = concentration of  $H_2S$  (mg/Kg) in the noncondensable gas line.

$NCGR$  = noncondensable gas flow rate (lb/hr).

$CCD_{H_2S}$  = concentration of  $H_2S$  (mg/Kg) in the condensate.

$CDR$  = condensate flow rate (lb/hr)

$ER_{H_2S}$  = emission rate of  $H_2S$  (lb/hr)

## 6. Quantity of Emissions

The Operating Permit, Condition II.2, prohibits the release of air contaminants into the atmosphere from any single processing unit in excess of 0.2 grains per cubic foot of gas. This limit will apply to the release of gases from the cooling tower which includes noncondensable gases plus any volatile pollutants separated into the condensate ( $H_2S$  and  $NH_3$ ) when condensate is used for the make up water. Compliance with this limit will be monitored quarterly. The emission of noncondensable gases will be quantified by measuring the gas flow rate at the noncondensable gas line. The emission of volatile pollutants that separate into the condensate will be quantified by sampling the condensate line and measuring the condensate flow. In order to evaluate the  $H_2S$  emissions, a 24% oxidation rate will be assumed for oxidation of hydrogen sulfide to sulfate unless another oxidation rate is obtained by source testing of the cooling tower exhaust. The emissions from the noncondensable line and the fraction of volatiles in the condensate, in pounds per hour, will be divided by the air exhaust flow rate (cu.ft/min) in the cooling tower.

Quantity of emissions will be evaluated using the following equation:

$$\text{Emissions lb/hr} \times \text{hr/60 min} \times 7000 \text{ grains/lb} \times \text{min/exhaust ft}^3 = \text{grains/ft}^3$$

## 7. Well Maintenance and Well Drilling Portable Equipment

Maintenance work on the existing geothermal wells or drilling of a new geothermal well entails the use of a contractor work over rigs or a drilling rig. The work over rig and drilling rig equipment is driven by internal combustion engines. None of this equipment is owned by GEM Resources, LLC. All of the work over rig and drilling rig equipment is mounted on wheels or platforms and none of this equipment remains at the facility for more than 12 consecutive months. The work over rig and drilling rig equipment meets the definition of portable engines of 40 CFR Part 89.2. The combustion emissions from the work over rig

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and drilling rig equipment will not be included in the emission inventory for the facility for the purpose of major source determination.

According to the U.S. EPA guidelines for portable engines, no emission standards will be imposed to the portables engines. However, the District will retain its authority to issue preconstruction permits to set limits on hours of operation, mass emission rates, and assure compliance with any requirement of SIP-approved and District's Rules and Regulations. As an alternative, the work over rig and drilling rig contractors will meet the permitting requirements by registering the equipment with the State.

#### 8. Monitoring and Reporting Schedule.

The facility will comply with the following monitoring and reporting schedule:

Permit Condition	Description	Due Date
IV.1 and V.3	Monitoring and Reporting of H <sub>2</sub> S (Cooling Tower)	Every Six Months
IV.2 and V.3	Monitoring and Reporting of Benzene and Ammonia/ Cooling Tower	Every Six Months
IV.4 and V.6	Monitoring and Reporting of Several Compounds	Annually
V.1	Report of any Deviation other than Breakdowns	Within 2 days
V.2	Monitoring Report/Written Report	Every Six Months
V.4	Report of Quantity of Emissions	Every Six Months
V.5	Report of Sulfur Compounds Emissions	Every Six Months
V.6	Operating and Production Report	Annually
VIII.1 and V.7	Breakdown Notification (1) and Report (2)	(1) 2 hours (2) Within Ten Calendar Days

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IX.1	Compliance Certification Report	February of each Operating Year
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### **Insignificant Activities**

The following types of activities and emission units were exempted from the Title V permit requirements.

1. Lube Oil tanks. 11 - 1000 gallon lube oil tanks in well field. Lube oil storage tanks will be exempted due to the low volatility of lube oil, vapor pressure < 0.1 psia. Exemption was based on Rule 202.E.8.c and the guidelines on Title V Operating Permit Program Submittal, Attachment "C," List of Trivial Activities.
2. Diesel storage tanks. Diesel storage tanks will be exempted due to the low volatility of diesel, vapor pressure < 0.1 psia. Exemption was based on Rule 202.E.8.c and the guidelines on Title V Operating Permit Program Submittal, Attachment "C," List of Trivial Activities.
3. Solvent part cleaners. Rule 202.E.9.b exempts unheated nonconveyorized cleaning equipment with a surface area less than 1.0 sq.m., using organic solvents with an initial boiling point of 160 C or greater, and losing less than 25 gal/yr of solvent to the atmosphere. The solvent used at the cleaning station has an initial boiling point of 177 C, the area is smaller than 1 sq.m., and loses are less than 25 gal/yr.
4. Painting. Plant maintenance and upkeep activities, such as painting, will be exempted based on the guidelines on Title V Operating Permit Program Submittal, Attachment "C," List of Trivial Activities.
5. Repair and maintenance. The repair and maintenance shop activities not related to the source's primary business activities will be exempted based on the guidelines on Title V Operating Permit Program Submittal, Attachment "C," List of Trivial Activities.
6. Motor vehicles and warehouse forklifts. Combustion emissions from propulsion of mobile sources will be exempted based on the guidelines on Title V Operating Permit Program Submittal, Attachment "C," List of Trivial Activities.

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7. Skimmer pump. Internal combustion engines with a rating of 50 bhp or less will be exempted based on Rule 202.E.1.a.
8. Portable generator, portable steam cleaner, and water heaters/steam cleaners. These units will be exempted because they are included in the list of trivial activities of the Title V Operating Permit Program Submittal, Attachment "C."
9. Gasoline tanks. Unheated solvent dispensing containers with a capacity not more than 250 gallons will be exempted based on Rule 202.E.8.a.
10. Well Pad Cooling Towers. Water cooling towers that have a circulation rate of less than 10,000 gallons per minute and which are not used for cooling of process water or water from barometric condensers will be exempted based on Rule 202.E.4.a.
11. Unheated Cleaning Equipment and Office Activities and Equipment. The consumers use of janitorial products and consumer use of office equipment and products will be exempted based on the guidelines on Title V Operating Permit Program Submittal, Attachment "C," List of Trivial Activities.

### **Supplemental Annual Fee**

The supplemental annual fee for the facilities will be determined according to the guidelines of Rule 900.G. The supplemental annual fee will be calculated according to the following equation:

$$s = [ \$ 33.82 \text{ per ton (CPI adjusted)} \times e ] - f$$

where:

s = supplemental annual fee in dollars  
e = fee-based emissions in tons per year

Actual rates of emissions for which fee-based emission schedule applies:

Hydrogen Sulfide	= 22.1
Benzene	= 32.0
Total	54.1

f = sum (in dollars) of annual fees under Regulation III and AB2588:

GEM Resources, LLC/PEM Units 5 & 6 = \$ 5,550.00

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GEM Resources, LLC/Geo Well	= \$ 243.00
GEM Resources, LLC/Geo Wells	= \$ 4,212.00
AB2588	= \$ 107.00
<b>TOTAL</b>	<b>= \$10,062.00</b>

Total Emissions of Fee Pollutants:	54.1 tons/yr
Emissions of Fee Pollutants x \$ 33.82/ton:	\$ 1,829.66
Annual Fees under Reg.III and AB2588	\$ 10,062.00
Estimated supplemental Title V Program Fee:	(1,829.66 - 10,062.00) = \$ 0.00

These calculations indicate that the annual fee paid by the facilities under Regulation III and AB2588 exceeds the emission fee pollutant schedule under Rule 900 therefore no supplemental fee is required.